REMARKS

The application includes claims 1-38 prior to entering this amendment.

The applicants amend claims 1-5, 8-12, 15, 17-18, 20-25, 28-34, and 37-38.

The application remains with claims 1-38 after entering this amendment.

The applicants do not add new matter and request reconsideration.

An Information Disclosure Statement (IDS) is included herewith for submitting references cited in prosecution of the corresponding U.S. parent application, U.S. Ser. No. 10/723,118, and in the International Search Report for the PCT application corresponding to this parent, PCT/US04/39431. Also included, from the Request For Comments (RFC) series published by the Editor of the Internet Engineering Task Force (IETF), is RFC 3550, which generally describes the RTP and RTCP protocols (and which was incorporated, by reference, in applicant's original disclosure on page 10, line 17). This art is submitted pursuant to the requirements of 37 C.F.R. §§ 1.56, 1.97, and 1.98.

In Adhikari, test packets are transmitted between network endpoints (Fig. 3) as RTP packets in order to collect QoS measurements (par. 0056). QoS-related data about the packets is incorporated, at the endpoints, into the packets themselves (par. 0090). Also recorded in the test packet itself is the number and addresses of the routers passed during travel between the endpoints as well as the true path length based on the Time To Live (TTL) field (pars. 0097 and 0102-0104). RTCP is used by the endpoint to make the QoS report (par. 0108). In Partain, in like manner, a "probe" packet is sent between end nodes (denoted "Ingress" and "Egress" in Fig. 2; col. 3, lines 37-40) that records, within itself, "aggregated" path information as it travels between the endpoints. In particular, the probe packet is "marked" at each intermediate router where congestion is detected (col. 5, lines 25-33). The DiffServ codepoint of the probe packets may be varied to measure congestion levels for different packet classes (col. 5, line 66 to col. 6, line 6), and the path-related congestion information can be compiled in a report packet by one of the endpoints (col. 5, lines 51-55). It will be noted that neither Adhikari nor Partain describe the claimed approach of setting TTL values in the probe packets in such a manner as to intentionally cause faults or discards at the intermediate nodes.

Aggarwal describes a method in which a conventional UDP traceroute program (col. 1, line 62 to col. 2, line 13) is combined with Simple Network Management Protocol (SNMP) queries (col. 3, lines 43-48) to discover the particular routers along a network path. In particular, Aggarwal describes how an ICMP response from an intermediate node will be different than the ICMP response from a destination node (e.g., for the intermediate node, a "TTL_EXCEEDED" response is given, see col. 3, line 66; for the destination node, a "PORT_UNREACHABLE" response, see col. 4, lines 22-25). The User Datagram Protocol (UDP) packets employed in Aggarwal do not provide any packet ordering or sequencing services and thus do not suitably constitute "media" trace packets of the type claimed. Also, further distinctions noted in the Remarks section below in connection with the primary reference cited, Selvaggi et al., apply with equal force to Aggarwal.

Drawing Objections

The examiner objected to the drawings. A replacement sheet for Fig. 2 is attached hereto in which, in respect to items 222 and 224, the text "TTL=X=X+1" and "TTL=X=X+2," respectively, have been replaced by the text "TTL=X+1" and "TTL=X+2," respectively. A replacement sheet for Fig. 4 is also attached in which a reference number, 206, has been added to indicate the "TIME TO LIVE" field in the IP header, in accordance with applicant's original disclosure (e.g., page 10, line 14).

Claim Objections

The examiner objected to claims 9, 29, and 30-38 for informalities. These claims have been amended to correct the informalities in the manner indicated by the examiner.

Claim Rejections Under 35 U.S.C. § 112

The examiner rejected claims 4-7, 20, 24-27, and 33-36 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. These claims have been amended to overcome the indefiniteness rejection. In particular, in claims 4, 24, and 33 (which serve as base claims for claims 5-7, 25-27, and 34-36, respectively), the indefinite language "causing the destination endpoint" has been deleted. In claim 20, the reference to RTP packets "with the modified TTL

values" has been replaced by a reference to RTP packets "containing TTL values," with the substituted language finding direct support in parent claim 17. This resolves the indefiniteness rejection in respect to each of these claims.

Claim Rejections Under 35 U.S.C. § 102

The examiner rejected claims 1-7, 9-27, 29-36, and 38 under 35 U.S.C. § 102(e) as being anticipated by Selvaggi, *et al.*, (U.S. Patent Application Publication No. 2004/0193709).

Claims 1-7 and 9

Independent claim 1 is generally directed to a method of analyzing a media path by varying a Time-To-Live (TTL) value in media trace packets so as to intentionally cause faults at intermediate nodes in the media path and analyzing the fault notices thereupon received from these intermediate nodes. Claim 1 is herein amended to add the step of "providing media trace packets having a data header field assigned the same priority value as actual media payload packets to be sent along the media path." Support for this step is provided in applicant's original disclosure, which explains that the media trace packets are like "normal voice RTP packets" including "with the same Differentiated Services Code Point (DSCP) bits" (page 5, lines 11-12), and also in applicant's Fig. 4, which shows the related "Type Of Service" (TOS) field in the IP header 239. Those of ordinary skill will recognize that in respect to the IPv4 protocol, for example, the DSCP bits represent 6-bits of the 8-bit Differentiated Services (DiffServ) field, of which the first three bits mark the packet as being within one of four priority classes, which convention is backwardly compatible with the first three "precedence" bits (bits 0-2) of the (former) TOS field. In other words, claim 1 now specifies that the media trace packets are originally provided with the same priority marking as the actual media payload packets that will be using the media path.

Selvaggi et al., as cited in the Action, does describe "media trace packets" (e.g., of RTP format) that have TTL fields varied to cause "error messages" at intermediate (connecting) nodes along a media (VoIP) path (par. 0051); however, Selvaggi stresses the importance of simulating VoIP traffic (par. 0052) and, in particular, simulating such traffic using the payload of the RTP (media trace) packet because "routers may treat packets differently depending on their payload" (par. 0054; see also par. 0059 discussing "including VoIP data in the RTP payload"). In

distinction to Selvaggi's approach, amended claim 1 highlights the importance of matching, in the "header" field of the original media trace packet (not its "payload" field) the "priority value" of the actual media payload packets (versus merely duplicating VoIP content). The approach of amended claim 1 ensures that the media trace packets and actual media payload packets start along the media path with the same priority value so that the QoS-related network conditions experienced by the trace packets will more closely reflect those encountered by the actual media payload packets.

Based on the foregoing remarks, amended claim 1 has now been shown to patentably define over Selvaggi et al. Claims 2-7 and 9, each depending from claim 1, contain every limitation of claim 1 and likewise define patentably over the art. However, even independently of base claim 1, at least claims 2-3 and 5, as amended, patentably define over the art, as will now be described.

Amended claim 2 requires formatting the media trace packets as Real Time Protocol (RTP) payload packets that travel "starting with the same priority value" along the same media path as RTP payload packets containing media content with "the same priority value being assigned by an Internet Protocol (IP) header field." In other words, amended claim 2 clarifies that the media trace packets not only start along the "same media path" but also "with the same priority value" as the media content packets (possibly subject to later change by an intermediate network device) and that this priority value, though associated with trace packets formatted as RTP packets, is actually assigned in the Internet Protocol (IP) header field (see the "Type of Service" field included in the IP header 239 in applicant's Fig. 4 in conjunction with the above discussion of claim 1). Selvaggi et al., as cited in the Action, may describe RTP trace packets, but says nothing about the importance, when collecting QoS-related information about media paths using media trace packets, of matching packet priorities as well as physical paths. Nor does Selvaggi say anything about the significance of matching fields not only in the media-carrying layer (e.g., RTP) but also in other protocol layers (e.g., in the IP protocol layer). Accordingly, even independently of claim 1, amended claim 2 patentably defines over the cited art.

Amended claim 3 requires conducting a media signaling protocol establishing the media path between a source and destination endpoint, using a same media header format for the trace and media payload packets, and setting the TTL values in the trace packets low enough to cause a fault condition in one of the intermediate nodes "such that a portion of each media trace packet

causing the fault condition is returned in a corresponding reject notice to the source endpoint." As indicated in applicant's original disclosure (e.g., on page 6, line 21) this approach enables, for example, the source endpoint to better correlate each reject notice with the particular media trace packet responsible for causing the notice (see original disclosure, page 6, lines 22-23). Thus, referring to applicant's Fig. 4, the reject notice may incorporate the RTP header fields of the responsible trace packet, which is useful for identifying the trace packet's original source (e.g., the synchronization source/SSRC and contributing source/CSRC identifiers) as well as for providing valuable QoS information (e.g., sequence number and timestamp).

Though Selvaggi is somewhat vague concerning what information is specifically contained in its "error messages" (see par. 0051), Selvaggi's error messages provide a "TTL expired in transit" alert corresponding to that of an Internet Control Management Protocol or ICMP packet (of type 11, code 0). In other words, the error message that Selvaggi returns when the TTL value of its RTP trace packet reaches zero at an intermediate node appears to be a conventional ICMP notice. However, desirable information may be lost using such ICMP return notices. For example, the IP source and destination addresses contained in the IP header portion of the ICMP notice may be modified from those of the original RTP trace packet if this trace packet is mixed with other RTP packets during its travel along the media path (under the claimed approach, the SSRC and CSRC identifiers that may be included from the original media trace packet overcome this difficulty). Furthermore, while QoS information may be extracted from the ICMP notice (using, for example, the ID and Sequence fields obtainable with the IP protocol to correlate return ICMP notices with particular outgoing trace packets), such QoS information only relates to round-trip characteristics (along the entire path between the source and intermediate node and back again) and not to one-way travel characteristics (as may be preserved under the claimed approach by recording in the reject notice, when the responsible media trace packet arrives at the intermediate node, the timestamp and sequence number of this trace packet as well as the corresponding SSRC or CSRC address.) For such reasons, then, amended claim 3 patentably defines over the art of record even independently of its base claim, claim 1.

Amended claim 5 is directed to a method in which a member bit in the media trace packet causes the destination endpoint to "immediately" generate a media path analysis report for the media trace packets. As related claim 6 makes clear, this report may constitute a Real Time

Control Protocol (RTCP) report. Support for amended claim 5 is provided in applicant's original disclosure, for example, on page 14, lines 23-25.

It may be noted that the time from when the report is generated to when it is sent may, if desired, be varied depending, for example, on bandwidth controls conventionally designed to mitigate network congestion when RTCP is used (see applicant's disclosure, page 19, lines 20-23). It may also be noted that there is a difference between the fault notice sent back by an intermediate node (e.g., which in one preferred embodiment is an ICMP-formatted message including part of the trace packet in its payload as used by the source for conducting the QoS analysis; see applicant's disclosure, page 4, line 7; page 5, line 27 to page 6, line 3; and page 6, lines 21-23) and the analysis report sent back by the destination endpoint or node (e.g., which in one preferred embodiment is an RTCP-formatted message with the QoS analysis conducted at the destination before the message is returned to the source; see applicant's disclosure, page 14, lines 23-25 and page 17, lines 5-8).

In Selvaggi et al., there is no explicit mention of an "analysis" (or RTCP) report being generated at the destination node upon trace packet receipt. Indeed, Selvaggi appears to suggest that the destination node returns an "error message" (or ICMP notice) like those generated by the intermediate nodes (see fourth-to-last sentence in par. 0051; such a notice might indicate an unreachable destination using a Type 3 ICMP alert, as described in the Aggarwal et al.reference that was earlier mentioned at the beginning of these Remarks). Even presuming that Selvaggi provides, for example, RTCP reports at the path destination in response to RTP trace packets, there is nothing in this reference to suggest that such RTCP reports are, as claimed, generated "immediately" based on triggering by "a member bit" in the trace packets (e.g., which identifies a series of trace packets as being members of the same TTL group). At best, Selvaggi would periodically generate and send RTCP reports in accordance with a conventional "report interval" designed to be increased as the number of intended recipients increases (see RFC 3550, first paragraph on pages 26 and 27; note that RTCP "feedback" reports, even when based on RTP packets from one source, are typically broadcast to many participants to allow each participant to discriminate between local and global path problems; see RFC 3550, page 20, first paragraph). In other words, conventional generating and sending of RTCP return packets does not provide for separate grouping, analysis, and QoS reporting on only those media trace packets involved in the

"last" jump to the destination node (as demarcated by the claimed "member bit"). Hence, even apart from base claim 1, amended claim 5 patentably defines over the cited art.

Claims 10-16

As a preliminary matter, it will be noted that base claim 10 has been amended and that corresponding minor amendments have been made, in particular to dependent claims 11 and 12, solely to preserve proper antecedent basis. Apart from this comment, these particular dependent claims are not further discussed separately in these Remarks.

Independent claim 10, as amended, is directed to a network processing device capable of establishing an IP network media session and modifying a Time To Live (TTL) value "in respective sets of" media trace packets that intentionally cause rejection by "corresponding respective" intermediary nodes used in the media session "where transmittal of the respective sets of media trace packets is selectively subject to rate-limiting control." In other words, the interval between transmission of respective sets of the media trace packets can be selectively increased or decreased. Support for amended claim 10 is found in applicant's original disclosure on page 11, line 24, which also indicates that this approach can be used to mitigate DoS (denial of service) attacks. That is, if such an attack occurs so as to conventionally cause flooding of the network, traffic congestion can be reduced by decreasing (or "rate-limiting") the transmission of the media trace packets. While Selvaggi does disclose a processing device (Fig. 4) for use at the endpoint nodes that includes a routing module 460 providing simulated media packets of decrementing TTL value in order to serve a traceroute function (see pars. 0049-0051), nowhere does Selvaggi mention providing rate-limiting functionality in respect to transmission of these path-tracing packets. Thus amended claim 10 patentably defines over the cited art, and so also do claims 11-16, which depend from claim 10 and contain every limitation of that base claim. However, as will now be described, at least claims 14 and 15 patentably define over the art even independently of claim 10.

Claim 14 calls for the processing device of claim 13, wherein the claim 10 processor interjects media trace packets in the same session with the actual media payload packets when a "trigger event" is detected, which trigger event is specified as being a Real Time Control Protocol (RTCP) report. That is, the source processor (as defined by claim 10) is induced to send media trace packets when triggered by an RTCP report prepared by the destination processor for the session. As noted above in the discussion of claim 5, Selvaggi says nothing about RTCP

reports. (Paragraph 0051 of Selvaggi, as cited in the Action, refers to "error messages" being returned, from both the intermediate and destination nodes, that provide the type of "TTL expired" alert traditionally associated with an ICMP message.) At best, even if one deems RTCP reports to be a secondary result attributable to Selvaggi from its use of RTP-formatted packets, Selvaggi nowhere describes using such RTCP reports to serve as a trigger, in the context of a media session in which actual media payload packets are exchanged, for the source processor to interject trace packets in order to test the intermediate nodes. Thus claim 14, even independently of claim 10, patentably defines over the art.

Claim 15 calls for the processing device of claim 10 wherein the TTL values are modified "in media trace packets" that are formatted as media payload packets that contain no actual media payload "but rather contain an artificial media payload of low volume noise." Support for this feature is found in applicant's original disclosure on page 11, lines 20-21. This claim is related in coverage to that of claims 8, 28, and 37, which are discussed below in the section of these Remarks that cover obviousness rejections. At this juncture, suffice it to say that using such a payload facilitates regulation of the size of the media trace packets. Thus the media trace packets are readily conformed to the uniform size of regularly sampled actual media payload packets (see applicant's disclosure, page 21, lines 22-24) to enable normal receiver processing at the destination while avoiding, due to the low volume noise, disturbing playback effects (see disclosure, page 11, lines 20-21). Moreover, the average rate of transmission of the trace packets from the source is thereby readily controlled or rate-limited so as to mitigate network congestion of the type caused, for example, by denial-of-service (DoS) attacks (see disclosure, page 11, lines 22-24). Selvaggi only mentions "simulating VoIP traffic in a payload" of its RTP traceroute packets (par. 0054) in order that intervening routers will treat these packets like conventional VoIP packets but fails to further mention that randomly or artificially generated "low volume noise" may also be used. For further discussion of this feature in connection with art other than Selvaggi, see the discussion below of claims 8, 28, and 37.

Claims 17-20

As a preliminary matter, confusing labels in independent claim 17 and its dependent claim 18 have been revised so that they now read as references to media "trace" packets instead of media "payload" packets. This more clearly delineates the trace packets from packets

containing actual media payloads and is consistent with the manner in which these terms are used in claims that have already been discussed. In addition, surplus language in dependent claim 18 has been deleted. Apart from this, dependent claim 18 is not further discussed separately in these Remarks.

Claim 17, as amended, is directed to an intermediary node in an IP media session comprising a processor configured for decrementing the Time to Live (TTL) values of media trace packets with TTL values intentionally set to be discarded before receipt by the session destination, discarding the trace packets when the decremented TTL values are zero, and sending out a rejection notice for any discarded trace packets "where transmittal of respective rejection notices is selectively subject to rate-limiting control." Support for amended claim 17 is provided in applicant's original disclosure on page 11, lines 23-24 as read in conjunction with page 5, lines 26-28. Conventionally, when the processor of an intermediate node decrements the TTL value of a trace packet to zero (generally a UDP trace packet, though Selvaggi does describe using RTP trace packets in par. 0051), it immediately generates and returns an ICMP "TTL expired" alert (e.g., ICMP message type 11, code 0). Certainly Selvaggi suggests nothing more than this. However, amended claim 17 further requires that transmittal of such rejection notices by the intermediate node be "selectively subject to rate-limiting control." In other words, under the approach of claim 17, the processor of an intermediary node may selectively limit the rate at which QoS-related rejection notices are returned in a manner traditionally associated with a destination node. It will be noted that a destination node may wait to return a QoS-related RTCP report subject to whatever bandwidth-limiting controls are in place (for example, the reporting interval between scheduled RTCP reports is conventionally increased with the number of RTCP recipients; see the first paragraph of page 27 of RFC 3550). The claimed feature may thus be used, for example, to mitigate network congestion during a denial-of-service (DoS) attack (see applicant's disclosure, page 11, lines 23-24). The usefulness of this feature will be further recognized upon considering that each intermediate processor in the media path will preferably generate multiple reject notices to facilitate QoS analysis of each node or link back at the source.

Based on the reasons just given, amended claim 17 patentably defines over the cited art, and so also do claims 18- 20, which depend from claim 17 and share every limitation of that base claim. Even apart from claim 17, however, at least claim 20, as amended, independently defines patentably over the art.

Amended claim 20 calls for the media trace packets received by the intermediary processor of claim 17 to be RTP packets containing TTL values that enable passage through a firewall between a source endpoint and a destination endpoint for the media session "while also immediately causing selectively the destination endpoint to generate a QoS-related notice" (e.g., an RTCP report, see applicant's original disclosure, for example, on page 14, lines 23-25). As a preliminary note, it will be recognized that the predetermined destination address and port of session-based RTP trace packets will normally ensure their passage through a firewall (as contrasted, for example, with a UDP traceroute packet specifying ephemeral ports; see applicant's disclosure, page 1, lines 21-22 and page 2, lines 9-10).

Of more particular note, it will be recognized that the subject matter of amended claim 20 is, in a sense, the complement of the subject matter of amended claim 17. That is, whereas claim 17 describes, in the context of an intermediary processor, a rate-limited report-returning functionality more conventionally associated with a destination processor; claim 20 describes, in the context of a destination processor, an immediate report-generating functionality more conventionally associated with an intermediary processor. That is to say, it is conventional for destination processors to generate and send a QoS-related RTCP report according to a rate-limited schedule (rather than to selectively generate the RTCP report "immediately," as claimed). This is done so that networks are not unduly congested by RTCP control reports, the likelihood of which increases as the number of RTCP recipients increases (as noted above, a destination node may receive RTP packets from one source and then broadcast the corresponding RTCP "feedback" report about those packets to multiple other sources so that these other sources can separately decide if network problems are "local" or "global;" see the first paragraph of pages 10 and 20 of RFC 3550). As further discussed above in connection with amended claim 5, the advantage to "immediately" generating, if not sending, the RTCP report "selectively" (e.g., based, in claim 5, on the presence of a special "member bit"), is that the QoS information contained in the RTCP report may then be limited to reflect packet conditions as seen only by related media trace packets involved in their "last" jump to the destination node (rather than as seen by all the RTP packets received at the destination during some reporting interval regardless of their TTL and relative timing relationship). Accordingly, amended claim 20 patentably defines over the cited art even independently of base claim 17.

Claims 21-27 and 29; also Claims 30-36 and 38

As noted in the Action (bottom of page 7), original claims 21-27 and 29 were system claims having corresponding limitations to those of method claims 1-7 and 9. This relationship has been preserved in the amended claims, so that the remarks above in support of the patentability, over the art, of amended claims 1-7 and 9 apply with equal validity and force to amended claims 21-27 and 29, respectively. Equivalent correspondence with amended claims 1-7 and 9 also holds in respect to the computer readable medium that is described in amended claims 30-36 and 38, respectively.

Claim Rejections Under 35 U.S.C. § 103

Claims 8, 28, and 37

The examiner rejected claims 8, 28, and 37 under 35 U.S.C. § 103(a) as being unpatentable over Selvaggi in view of Barrack, *et al.*, (U.S. Patent Application Publication No. 2004/0008715). In particular, while noting that Selvaggi "does not specifically disclose causing the media trace packets to play out low volume noise when received by a destination endpoint," the Action observes that "comfort noise insertion" is disclosed in Barrack (pars. 0012 and 0088) and would be obvious to add to Selvaggi "to avoid annoying the listener."

In response, applicant has amended claims 8, 28, and 37 so that each of these claims now specifies not only causing the trace packets to play out low volume noise when received by the destination but also that this low volume noise is caused "by inserting the low volume noise into media payload fields of the media trace packets before sending the media trace packets along the media path" (refer to applicant's disclosure, page 11, lines 20-21). In other words, Barrack only discloses inserting the low volume noise at the destination device itself (e.g., in playback scheduling engine 100 in Fig. 1), which occurs after (not "before," as claimed) the media packets have been sent along the media path. Such insertion is done, in Barrack, to mitigate the "eerie" blackout effect experienced during playback due to "silence suppression" techniques. In accordance with such techniques, "transmission" of media packets "of low signal energy" is suppressed at the sending end in order to reduce data transmission bandwidth (see Barrack, par. 0011). Accordingly, while Barrack might teach inserting low volume noise into media packets at the destination, it does not teach inserting such noise into the payload of packets "before" such packets are sent down the media path (which presumably would worsen the very problem of

network congestion that "silence suppression," as combined with Barrack's teachings, is designed to mitigate). What Selvaggi and Barrack fail to suggest, either separately or in combination, is that insertion of such low noise payloads in the media trace packets allow a conventional receiver at the destination end to process the media trace packets without special configuration (such as a component for inserting low noise) as if they were actual media payload packets and without any disturbing playback effects (such as sound or other media blackouts). Use of such low noise payloads makes it easy to pad the media trace packets to conform to the uniform size of regularly sampled actual media payload packets and facilitates sending trace and media packets at uniform rates to foil traffic analysis attacks (see applicant's original disclosure, page 21, lines 23-24 and page 23, lines 14-15). Such padding also facilitates deployment of the selectively rate-limiting packet processing mechanisms discussed above in connection with independent claims 10 and 17. Accordingly, claims 8, 28, and 37 define patentably over the cited art, whether taken separately or in combination, as to render untenable any obviousness rejection.

Conclusion

For the foregoing reasons, the applicants request reconsideration and allowance of claims 1-38. The applicants encourage the examiner to telephone the undersigned if it appears that an interview would be helpful in advancing the case.

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Respectfully submitted,

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Title: METHOD AND APPARATUS FOR ANALYZING A MEDIA PATH FOR AN INTERNET PROTOCOL (IP) MEDIA SESSION
Doc. No. 2705-325 /App. No. 10/797,689

ANNOTATED SHEET

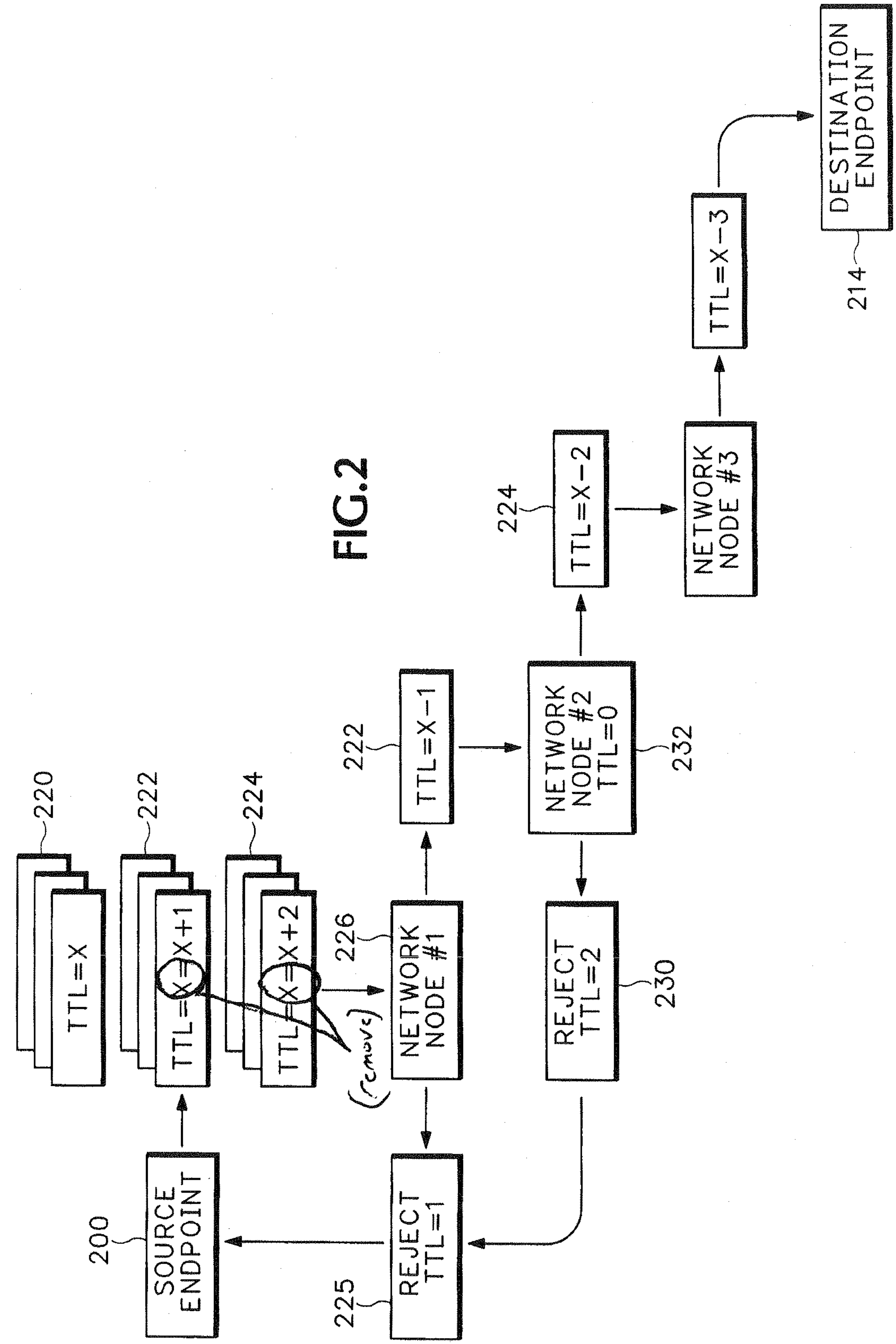

FIG.2

ANNOTATED SHEET

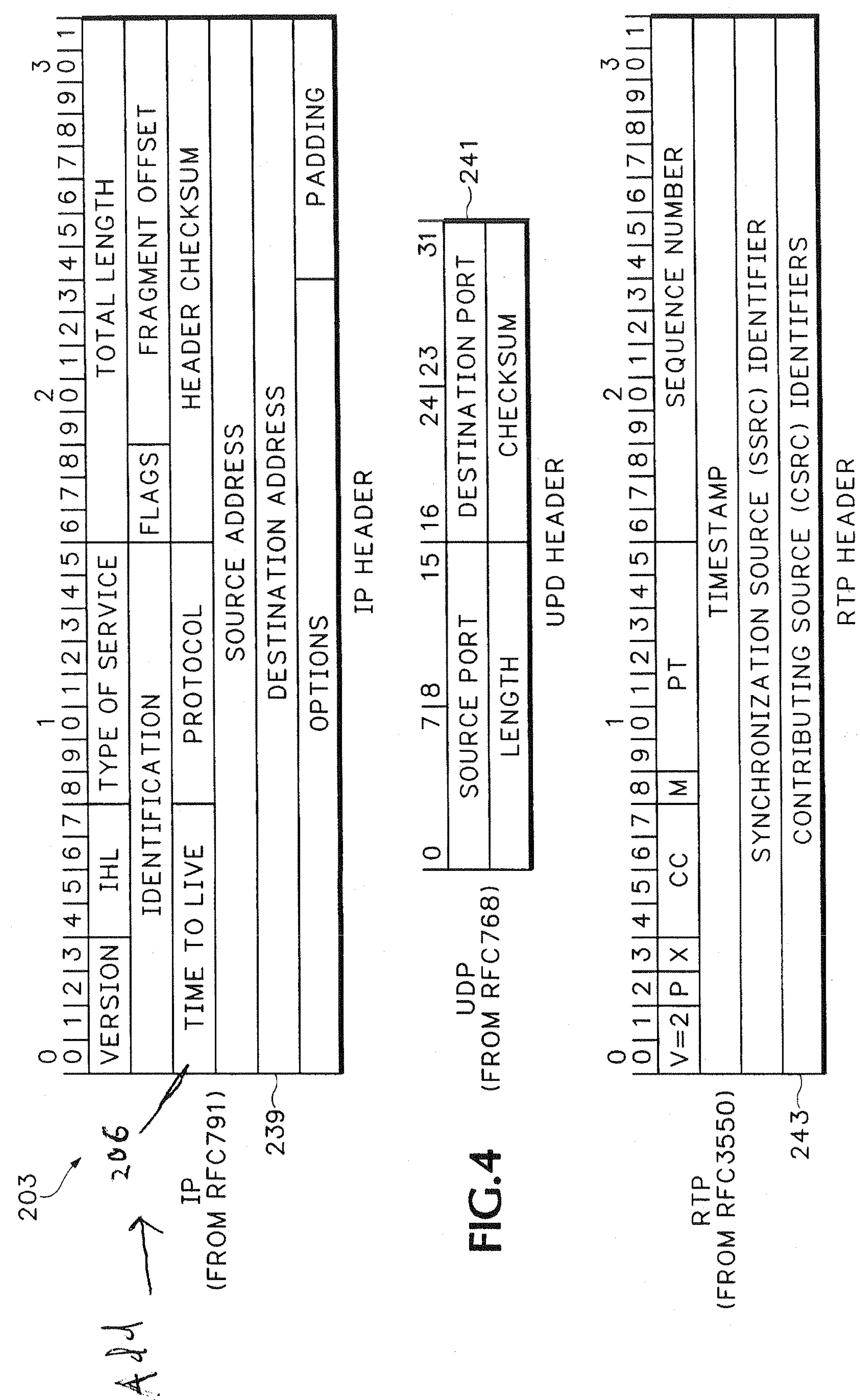

FIG.4